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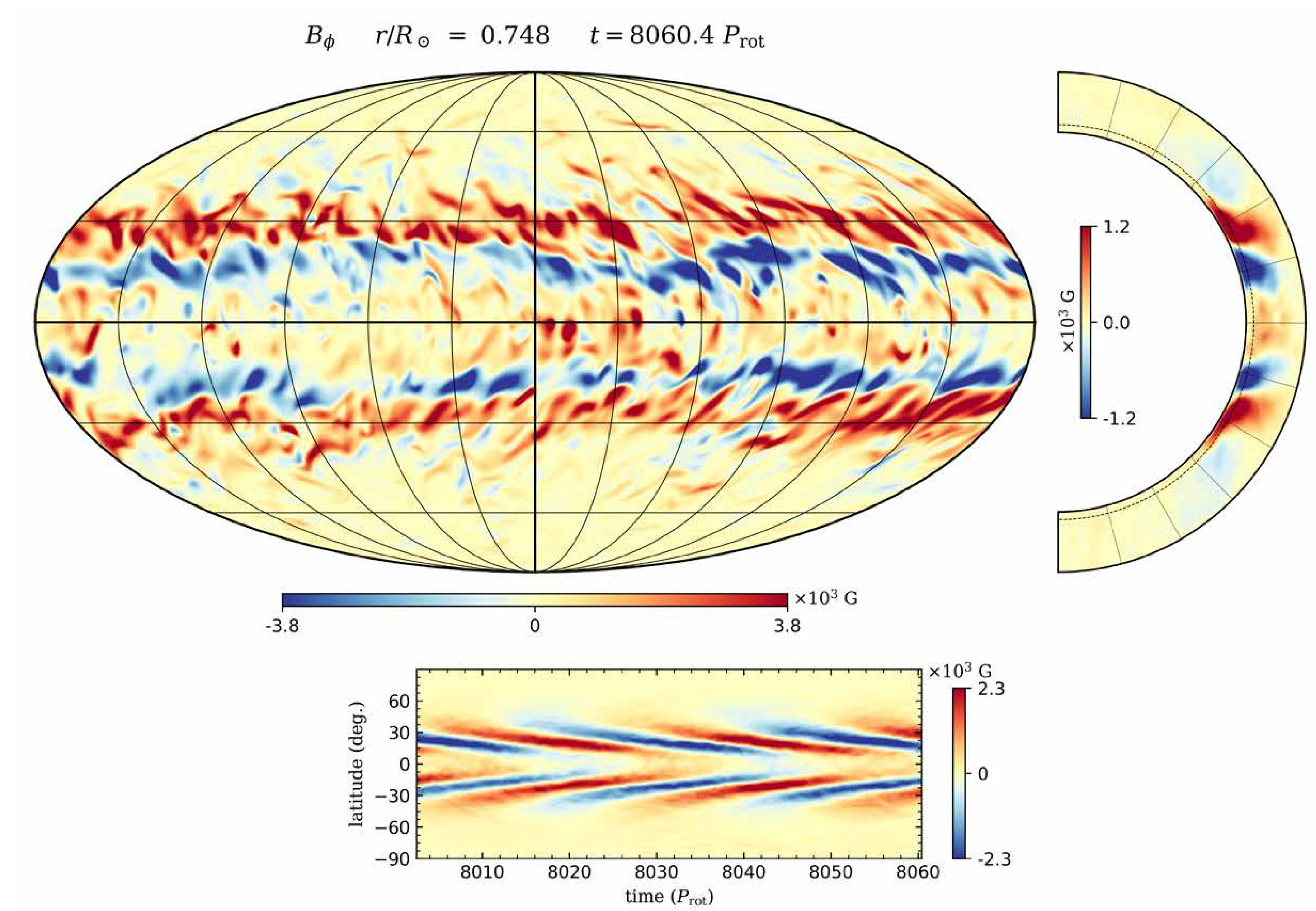
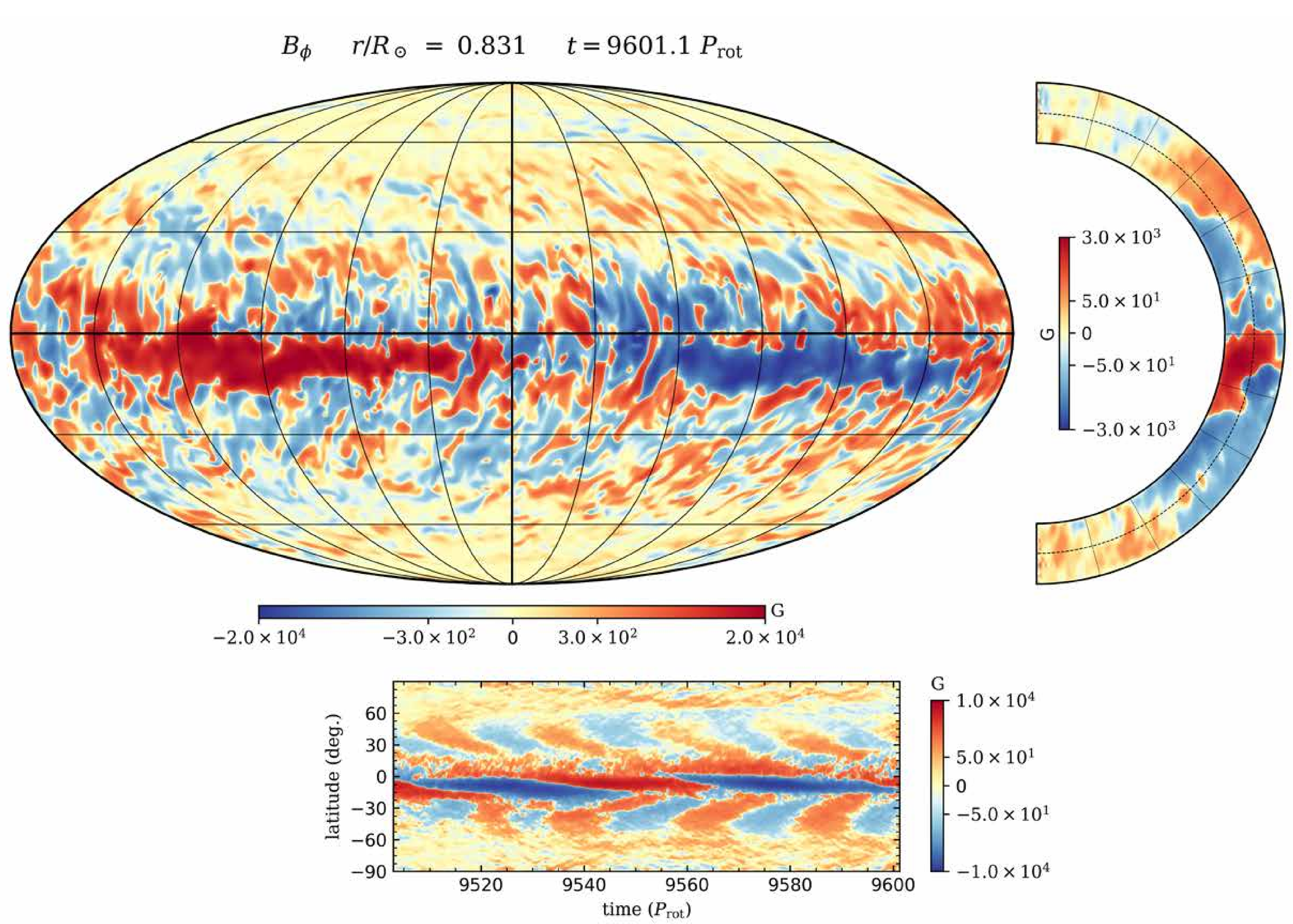


Snapshot of the solar azimuthal magnetic field achieved in one of the global solar dynamo simulations produced by researchers at the University of Colorado Boulder. Upper left: a spherical cut of the field near the bottom of the spherical shell is shown in Mollweide projection. Right: the azimuthally averaged field is shown in the meridional plane. Bottom: a time-latitude diagram of the azimuthally averaged field, similar to the observed solar butterfly diagram. The color intensity scales linearly with field magnitude. *Loren Matilsky, University of Colorado Boulder and JILA*



Snapshot of the solar azimuthal magnetic field, similar to the top image, but taken at a later time in the same simulation. Here, the field magnitude is mapped to color with a symmetric logarithmic function. This choice of color map captures both the high-intensity asymmetric magnetic field component in the southern hemisphere and the weaker, symmetric fourfold magnetic wreath in the background.
Loren Matilsky, University of Colorado Boulder and JILA

Discovering Distinct Cycles in the Global Solar Dynamo

The solar convection zone (CZ) is highly turbulent, yet remarkably shows large-scale order, most notably in the 22-year sunspot cycle. Scientists don't know where in the CZ sunspots originate, or the physical causes of the cycle itself. We seek to understand the dynamical origins of the sunspot cycle by running high-resolution, global magnetohydrodynamic simulations in rotating, convecting spherical shells. Our simulations, run on NASA supercomputers, produce two distinct forms of cycling magnetism, each of which are reminiscent of solar behavior. By comparing our results with NASA satellite observations, we will help constrain the solar dynamo and better understand how interior magnetism erupts in sunspots and creates solar flares and coronal mass ejections.

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